

What is claimed is:

1. A method for manufacturing a semiconductor device having a semiconductor substrate with a contact hole filled by an aluminum-containing thin film, comprising the steps of:

forming a silicon-containing thin film so as to fill the contact hole on the surface of the semiconductor substrate;

removing the part of the silicon-containing thin film outside the contact hole;

forming an aluminum-containing thin film on the surface of the semiconductor substrate after completing the step of removing the part of the silicon-containing thin film; and

heating the semiconductor substrate on which the aluminum-containing thin film is formed to such a temperature as to cause silicon to diffuse with respect to aluminum.

2. A method for manufacturing a semiconductor device as claimed in claim 1, wherein the step of forming an aluminum-containing thin film and the step of heating the semiconductor substrate are carried out simultaneously.

3. A method for manufacturing a semiconductor device as claimed in claim 1, wherein the step of

heating the semiconductor substrate is carried out after completing the step of forming the aluminum thin film.

4. A method for manufacturing a semiconductor device as claimed in claim 1, wherein the step of removing the part of the silicon-containing thin film includes a step of removing the part of the silicon-containing thin film outside the contact hole by etching back.

10 5. A method for manufacturing a semiconductor device as claimed in claim 1, wherein the semiconductor substrate is provided with a plurality of cells each including the contact hole, and

the ratio of the amount of silicon contained in  
15 the silicon-containing thin film per unit cell after completing the step of removing the part of the silicon-containing thin film to the amount aluminum supplied to a unit cell in the step of forming the aluminum thin film is not less than 0.1% and not more  
20 than 2% by atomic ratio.

6. A method for manufacturing a semiconductor device as claimed in claim 1, wherein the step of forming a silicon-containing thin film includes a step of forming a polysilicon thin film by chemical  
25 vapor deposition method.

7. A method for manufacturing a semiconductor device as claimed in claim 1, wherein the step of forming the aluminum thin film includes a step of forming an aluminum-containing thin film by sputtering method.

8. A method for manufacturing a semiconductor device as claimed in claim 1, wherein the step of heating the semiconductor substrate includes a step of heating the semiconductor substrate to 380°C ~ 570°C.